DOCUMENT RESUME

ED 070 873 VT 018 421

AUTHOR Nafziger, Dean H.; Helms, Samuel T.
TITLE Cluster Analyses of the SVIB, MVII, and Kuder OIS As Tests of an Occupational Classification.
INSTITUTION Johns Hopkins Univ., Baltimore, Md. Center for the Study of Social Organization of Schools.
SPONS AGENCY Office of Education (DHEW), Washington, D.C.
REPORT NO JHU-CSOS-138
PUB DATE Sep 72
GRANT OEG-2-7-061610-0207
NOTE 52p.
AVAILABLE FROM Johns Hopkins Univ., Center for the Social Organization of Schools, Baltimore, Maryland

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Career Education; *Classification; *Cluster Analysis; Cluster Grouping; Correlation; Interest Tests; *Occupational Clusters; Occupational Guidance; *Occupational Tests; Vocational Development; *Vocational Interests
IDENTIFIERS *Holland Occupational Classification; Kuder Occupational Interest Survey; Kuder OIS; Minnesota Vocational Interest Inventory; MVII; Strong Vocational Interest Blank; SVIB

ABSTRACT

This report was prepared by the Careers and Curricula Program, which is a career development and guidance program sponsored by The Center for Social Organization of Schools. As one of five Center programs which develop scientific knowledge of the schools' effects upon students and utilize this information to improve educational practices, this report from the Careers and Curricula Program examines the correspondence of various vocational interest inventories with the Holland Occupational Classification. Specifically, Holland's categories are compared with occupational groupings that result from the empirical application of McQuitty's Iterative, Intercolumnar Correlational Analysis to the occupational scales of the Strong Vocational Interest Black (SVIB), the Minnesota Vocational Interest Inventory (MVII), and the Kuder DD Occupational Interest Survey (OIS) Core Scales for Men and for Women. Results indicate that internally consistent occupational clusters do exist, and these usually agree with Holland's classification. The hierarchical structure of the clusters follows Holland's hexagonal ordering of categories, additionally attesting to the validity of Holland's theoretical construct. (Author/AG)

Center for Social Organization of Schools

OCT 20 1972

REPORT NO. 138
SEPTEMBER, 1972

CLUSTER ANALYSES OF THE SVIB, MVII, AND KUDER OIS AS TESTS OF AN OCCUPATIONAL CLASSIFICATION

DEAN H. NAFZIGER
SAMUEL T. HELMS

The Johns Hopkins University

STAFF

John L. Holland, Director

James M. McPartland, Assistant Director

Virginia B. Bailey

Joan E. Brown

Zahava D. Blum

Judith P. Clark

James S. Coleman

David L. DeVries

Keith J. Edwards

Gail M. Fennessey

James J. Fennessey

Linda P. Ferraris

Stephanie G. Freeman

Ellen Greenberger

Rubie J. Harris

Edward J. Harsch

Samuel T. Helms

Robert T. Hogan

John H. Hollifield

Karen L. Jaworski

Nancy L. Karweit

Steven J. Kidder

Samuel A. Livingston

Edward L. McDill

Rebecca J. Muraro

Alice J. Nafziger

Dean H. Nafziger

Julian C. Stanley

B. James Starr

John P. Snyder

Diana F. Ward

ED 070873

CLUSTER ANALYSES OF THE SVIB, MVII, AND KUDER OIS AS TESTS OF AN OCCUPATIONAL CLASSIFICATION

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

Grant No. OEG-2-7-061610-0207

Program No. R16J5
Project No. R16JA

Dean H. Nafziger

Samuel T. Helms

Report No. 138

September, 1972

Published by the Center for Social Organization of Schools, supported in part as a research and development center by funds from the United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education, and no official endorsement by the Office of Education should be inferred.

The Johns Hopkins University

Baltimore, Maryland

INTRODUCTORY STATEMENT

The Center for Social Organization of Schools has two primary objectives; to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Academic Games Program has developed simulation games for use in the classroom. It is evaluating the effects of games on student learning and studying how games can improve interpersonal relations in the schools. The Social Accounts program is examining how a student's education affects his actual occupational attainment, and how education results in different vocational outcomes for blacks and whites. The Talents and Competencies program is studying the effects of educational experience on a wide range of human talents, competencies, and personal dispositions in order to formulate -- and research -- important educational goals other than traditional academic achievement. The School Organization program is currently concerned with the effects of student participation in social and educational decision-making, the structure of competition and cooperation, formal reward systems, effects of school quality, and the development of information systems for secondary schools. The Careers and Curricula program bases its work upon a theory of career development. It has developed a self-administered vocational guidance device and a self-directed career program to promote vocational development and to foster satisfying curricular decisions for high school, college, and adult populations.

This report, prepared by the Careers and Curricula Program, examines the correspondence of various interest inventories with the Holland Occupational Classification.

ABSTRACT

This paper compares Holland's occupational categories with groups of occupations that result from the application of McQuitty's Iterative, Intercolumnar Correlational Analysis to the scales of the SVIB, MVII, and Kuder OIS for men and women. The results indicate that clusters of occupations exist that are internally consistent, and these usually agree with the groups of occupations in Holland's classification. The hierarchical structure of the clusters follows the hexagonal ordering of Holland's occupational categories that has been suggested in other studies. In addition, the usefulness of all three letters in Holland's occupational classification was demonstrated.

Introduction

This report investigated the usefulness of a theoretical occupational classification system developed by Holland. The objective was to obtain occupational data from sources independent of the information used to develop Holland's classification; to group these occupational data using an empirical technique, and then to compare the results of the empirical grouping with Holland's theoretical grouping. The correspondence between the results of the empirical and theoretical clusters would provide a test of the validity of Holland's Occupational Classification system.

The data used were the occupational scales of the Strong Vocational Interest Blank (SVIB), the Minnesota Vocational Interest Inventory (MVII), and the Kuder DD Occupational Interest Survey (OIS) Core Scales for Men and for Women. The empirical technique for grouping occupations was McQuitty's Iterative, Intercolumnar Correlational Analysis (McQuitty and Clark, 1968).

The classification system has been proposed, tested, and revised by Holland and his colleagues (Holland, 1959, 1966a, 1966b; Holland, Whitney, Cole, and Richards, 1969; Holland, Viernstein, Kuo, Karweit, and Blum, 1970; Viernstein, 1972). The classification contains six main categories -- Realistic, Investigative, Artistic, Social, Enterprising, and Conventional -- and 72 subcategories within the main categories, such as Realistic-Investigative-Enterprising, Realistic-Investigative-Social, etc. The classification comes from a theory of personality types and model environments (Holland, 1966a), and all occupational categories were derived from a single set of coordinating definitions -- six scale scores from the Vocational Preference Inventory (Holland, 1970). The development

of the classification has been described earlier (Holland et al, 1970). The classification has been extended to all occupations in the Dictionary of Occupational Titles (Viernstein, 1972).

A hexagonal ordering (Figure 1) of the six types based upon intercorrelations of the VPI scales was proposed by Holland, Whitney, Cole, and Richards (1969). The interrelationships of the scales have been supported and extended in several studies using several interest inventories and different samples of both men and women (Cole and Hanson, 1971; Edwards and Whitney, 1972; and Cole, 1972). On the hexagon, the adjacent categories are the most closely related types, the nonadjacent and nonopposite categories are the next most closely related types, and the opposite categories on the diagonal are the least related types. For example, Conventional types have their highest degree of relatedness with Realistic or Enterprising types, are moderately related to Investigative or Social types, and have their lowest degree of relatedness with Artistic types.

Figure 1

Method

The data used for the analysis of the SVIB were the intercorrelations for the 72 occupational scales of the SVIB (Campbell 1971, pp. 456-458). Analysis of the MVII was done using the 21 x 21 intercorrelation matrix of the MVII Occupational Scales found in the Manual (Clark and Campbell, 1965). Data used for the analysis of the OIS were the intercorrelations

of the 23 Core Scales for men, and the intercorrelations of the 21 Core Scales for women (Kuder, 1971, p. 58).

Since this research was concerned with the placement of objects or variables into discrete categories using multivariate information, a cluster analytic technique was appropriate (Borgen & Weiss, 1971). Clustering of the scales was accomplished by using McQuitty's Iterative, Intercolumnar Correlational Analysis (McQuitty and Clark, 1968).[1] The clusters that result from this analytical technique are internally consistent types. McQuitty defines type as:

> "a category of objects of such a nature that every object in the category possesses a common and unique combination of characteristics; every object in the category possesses all of these characteristics, and no object not in the category possesses all of these characteristics; a nonmember may possess some but not all of the characteristics." (1971, p. 1)

The successive division of the original interassociation matrix proceeds by first grouping many objects with relatively few characteristics in common, and then grouping few objects with many characteristics in common. Misclassifications occurring at higher levels are necessarily

---

[1] This technique groups objects on the basis of the similarity of their variation among the correlations. To apply the technique, a matrix of intercorrelations or interassociations among scales is required. A matrix of intercolumnar correlations is generated by computing the correlation of the i^{th} column and j^{th} column of interassociations for all i, j pairs. The resulting matrix is the first intercolumnar correlation matrix. Iterations of this process will usually result in the convergence of the successive intercolumnar correlation matrices to a matrix with elements +1 and -1, which can be divided into two submatrices each with all elements +1. The iterative process may then be applied to the original interassociations of each of the two resulting submatrices until they are in turn subdivided. Repeated application of the process is continued until all clusters consist of a single element.

carried on to lower groupings. It is useful to cross-validate the clusters with other data, but this was not possible in the present study.

In order to compare the resulting clusters and subclusters to the groupings of the Holland classification, we needed to assign weighted Holland codes to each cluster and subcluster. First, Holland three-letter codes were assigned to each occupation in the cluster or subcluster. We then counted the times each letter appeared in first, second, and third position of each occupational code and assigned a weight of three, two, and one, respectively, each time this occurred. Summing these values for each letter and then rank ordering all letters resulted in a group summary code for each cluster or subcluster. For large groups of occupations, as occur in the first divisions of the occupations in the cluster analysis, the group summary code conceals the diversity of the individual occupational codes. However, it does provide information about the general orientation of even heterogeneous clusters. At lower division points, the group summary code more accurately describes the occupations within the cluster.

Results

The classifying of occupations using the cluster analysis corresponded in most instances with the groupings provided by Holland's occupational classification. For clarity, the discussion of the cluster analysis will adhere to the following format. The nature of the first division of the scales into the two main clusters is described. Then, one part of the first division (Main Cluster I) is explained separately and completely.

Afterward, the second half of the first division (Main Cluster II) is described in the same manner. This format is used for the results of all four inventories.

SVIB Clusters

Figures 2 and 3 summarize the clusters resulting from the analysis of the SVIB. The first major division of the occupational scales yields two large groupings: Main Cluster I and Main Cluster II. Occupations of Main Cluster I may be characterized as scientific, literary, and artistic occupations; those of Main Cluster II, as business, administrative, and applied science occupations. The group summary code for Main Cluster I is I/A S R/E and for Main Cluster II is I/S ER. (Slashes separating letters indicate ties in the summary code scores.) The complete summary codes for each of these clusters and all subdivisions of them, as well as the entire cluster tree diagram for the SVIB, are in Appendix A. Throughout the report, briefer codes will be used.

Main Cluster I

The first primary cluster is a relatively homogeneous group of professional occupations. With respect to the hexagon in Figure 1, this group consists of occupations with the three adjacent letters IAS. To a large extent, the codes are merely permutations of IAS types, although the R and E dimensions have a small influence. The twenty-eight occupations within Main Cluster I subdivide into two groups of fourteen each.

Figure 2

When Holland codes are assigned to these occupations, one subdivision appears to be IA Directed while the other appears to be SA Directed.

The IA Directed Cluster. This cluster is comprised primarily of natural scientists, artists, and intellectuals. As a result, most Holland codes of these occupations have IA, AI or IS in the first two positions. The summary code for the cluster is IAS. On the basis of their Holland codes, College Professor (SIA) and Musician (ASI) seem slightly out of place in the IA Directed Cluster, as they would obtain a closer match with their codes in the SA Directed Cluster. The IA Directed Cluster itself breaks down into two groups: one group contains artists and intellectuals with high A interests (summary code IAS); the other contains natural scientists with predominantly I characteristics (summary code IA R/S).

The SA Directed Cluster. Occupations in this cluster are clearly oriented toward working with people. The demand for a high degree of interpersonal activity is reflected in the strong S orientation of the codes, which mainly have SA, AS, or SI in the first two positions. The summary code for the cluster is SAI. The E category, which is an adjacent hexagonal category to S, occurs frequently in the codes of this cluster. In fact, two predominantly Enterprising occupations -- Lawyer (EAS) and Investment Manager (ESC) -- fall in this cluster. The second of these occupations is incongruent with the SA Directed Cluster.

The SA Directed Cluster breaks into two subclusters; the basis for division apparently being the level of personal involvement required. The first subcluster contains occupations that observe human behavior in a detached manner, such as political scientist, journalist, sociologist,

and investment manager. The summary code for this subcluster is SAI. Occupations in the second subcluster -- for example, social worker, priest, lawyer, and music teacher -- demand direct involvement with people. Its summary code, A/S E/I, reflects a relatively more diverse composition.

Main Cluster II

Main Cluster II shown in Figure 3 is more heterogeneous than the first large cluster. It appears to be a residual set of occupations that did not belong with the relatively more homogeneous I/A S occupations in Main Cluster I.

Figure 3

The two large clusters resulting from the subdivision of Main Cluster II are an object-data oriented cluster and a business-sales-management oriented cluster. The first of the clusters appears to be IR Directed and the second, SE Directed.

The IR Directed Cluster. The eighteen occupations in this cluster are oriented toward the manipulation of data and objects, which is reflected in their Holland codes. Every occupational code but one begins with either R or I, and most of the codes have RI or IR in the first two positions. The summary code of the cluster is IRS. The joint R and I orientation of this cluster is consistent in view of the relatedness of the types. Both R and I types are relatively task-oriented and nonsociable, preferring occupational situations with low interpersonal involvement.

That differences do exist between the R and I categories is demonstrated when the IR Directed Cluster is further subdivided. The resulting split leaves one cluster which is directed toward the I vertex of the hexagon, and a second cluster which is directed toward the R vertex. Cartographer (RIA) and Veterinarian (IRS) are the only two occupations that fall into an unexpected occupational group.

It is interesting to note that a subcluster involving RS- coded occupations occurs. R and S are opposite types in Holland's theory (as indicated by their positions on the hexagonal configuration of the types). Therefore, occupations combining RS codes should consist of people unique in their relationship to other occupations. That this is indeed the case is reflected by the result of a single cluster containing all RS occupations with one RIS occupation.

The SE Directed Cluster. The second group of Main Cluster II, containing twenty-six occupations, is the largest and most heterogeneous of the clusters. As a group, the occupations in this cluster have a strong orientation toward business, sales, and management. The summary code for the cluster is SEI. More than any of the other clusters, the occupations in this group require a higher level of competence in interpersonal relations. Personal involvement is an important dimension in the cluster, as is typical in all E and S occupations.

Subdivision of the SE Directed Cluster results in two large subclusters. The first is a business, finance and sales cluster. Combinations of E and C in the codes are typical in this subcluster, as expected from its business orientation. However, the S and I dimensions also appear in these occupations as may be noted from the summary code EC S/I.

Further division of this subcluster results in one group of occupations that appears to be a pure set of ECS permutations (beginning with Banker and ending with Business Education Teacher), and another group of occupations that is difficult to interpret (beginning with Army Officer and ending with Pharmacist). The former consists of finance and sales occupations.

The second large subcluster of the SE Directed Cluster is composed of occupations that involve the management of people in institutional settings. Consistent with Holland's theory, the occupations in the subcluster are dominated by S and E codes, and the subcluster has a summary code of SEI. Three occupations with somewhat incongruent codes appear in the cluster: Rehabilitation Counselor (SIA), Elementary Teacher (SAI), and Chiropractor (ISR).

A further division of this second subcluster results in one group of occupations that involves sales and administration and another group that involves contact with people in educational and recreational settings. Most occupations in the sales and administration group have a first-letter code of E. With one exception, the occupations in the educational and recreational subcluster have a first-letter code of S. The Holland codes for these groups are consistent with the general orientation of the occupations in the clusters.

MVII Clusters

The MVII was developed to measure the interest patterns of men in nonprofessional occupations. When Holland occupational codes are assigned to each of twenty-one occupations in the inventory, sixteen are classified

as Realistic, two as Social, two as Enterprising, and one as Conventional. In Holland's terminology, then, the MVII measures interests that are characteristic of primarily realistic type occupations. In general, any analysis of these occupations would be one which examines intragroup differences of interests of a rather homogeneous group -- differences that have been assured by the methodology employed in developing the MVII and used in differentiating the criterion group scales from the Tradesmen-In-General group.

The clusters resulting from this analysis are summarized in Figure 4. The complete cluster tree diagram as well as the group summary codes for all levels of the clusters are presented in Appendix B. The first major division of the MVII occupational scales yields two large groups: Main Cluster I (nine occupations) and Main Cluster II (twelve occupations). A people versus object orientation appears to account for this grouping. For Main Cluster I, the summary code is RSE; for Main Cluster II, RIC.

Figure 4

Main Cluster I

The first large cluster of the MVII occupational scales consists of occupations that require interpersonal interaction, often in a salesperson-customer relationship. The sort of work done in these occupations is of the light duty, clean hands type. The orientation toward people is reflected in the Holland codes of the occupations. All of the MVII occupations which have codes beginning with S, E, or C are found in Main Cluster I.

Main Cluster I, having a summary code of RSE, branches into two subdivisions of three and six occupations each. The summary codes are SR I/C/E for the former and RES for the latter. This grouping subdivides those occupations with largely a SR orientation from those occupations with relatively less of S but with more E and C components.

The first subdivision, the SR Oriented Cluster containing three occupations, divides once again. The Hospital Attendant (SRC) splits off by itself and the Food Service Manager (SEC) and Baker (RIS) remain together.

The second subdivision, the RES Oriented Cluster, initially remains intact while the Warehouseman (RSE) splits off by itself. That a unique set of characteristics appears to accompany RS codes is again suggested by the separation of Warehouseman, the only RS occupation, from the larger group. The remaining five occupations then divide cleanly into a group of two occupations with ES- codes and a group of three with RC- summary codes.

Main Cluster II

The second large cluster is oriented toward object manipulation. In contrast with Main Cluster I, this cluster is typified by occupations involving heavy work, manipulation and modification of materials, and getting one's hands dirty. Generally the occupations are blue-collar jobs requiring little close, interpersonal contact, and this is reflected by a paucity of an S dimension in the codes. Without exception the occupations in Main Cluster II have R as the first letter of the Holland code. The summary code for the cluster is RIC.

At the first division of Main Cluster II a notably clean split occurs. One subdivision consists of five occupations that have identical first and second letter codes of RI followed by either S or E as the third letter. The other subdivision groups seven occupations with either RC or RI as the first two letters. The former appears to be an RI Oriented Cluster and the latter an R C/I Oriented Cluster.

The RI Oriented Cluster further divides into one group of two and one group of three occupations, each with the same RI summary code. The second subdivision, the R C/I cluster, divides into two groups of three and four occupations each. The division occurs at the second letter (a tie), with RC- occupations grouping together and RI- occupations grouping among themselves. There is one exception to this (Truck Driver, RCE).

Kuder DD OIS Clusters for Men

Figure 5 summarizes the clusters resulting from the analysis of the OIS Core Scales for Men. The complete summary codes and the cluster tree diagram are shown in Appendix C. The first major division yields two groups: Main Cluster I (eight occupations) with an RIE summary code and Main Cluster II (fifteen occupations) with a summary code of ISA. Within Main Cluster I the occupations are those which typically deal with objects, data, and things. Those within Main Cluster II may be described

Figure 5

as quantitative and life science occupations combined with a subcluster

of people and business oriented occupations. This clustering in terms of object-data-things versus scientific-social-business is reflected in the Holland group summary codes of RIE and ISA for the two clusters, respectively.

Main Cluster I

The occupational titles for the scales in this first primary cluster mirror the manipulation and modification of materials, objects and data orientation of this group. Subdivision of Main Cluster I results in a group with five occupations and another with three occupations. In the subdivision with three occupations, the engineering occupations and engineering college major remain together and make up an object-data oriented subcluster with an IRE summary code.

The occupations that remain together in the other subcluster have an RI- summary code and, although not as homogeneous as the engineers, seem congruent with one another. Four of the five occupations require activities, competencies and interests typical of Realistic people. The one exception is Banker (ECI).

The RIE summary code for the main cluster and RI- and IR- for the two subdivisions seem to summarize the nature of the clustering rather well.

Main Cluster II

Scientific, social, and business occupations comprise this large group. The ISA summary code for the main cluster reflects these components. Those which are primarily natural, physical, or biological

scientists and generally quantitatively oriented remain together in an IA R/S subcluster; while those which are people and business oriented group with one another in an SEI cluster. The letters for the group codes describe well the nature of the difference between the occupations in these two subclusters.

The occupations of the first subcluster, the scientists (beginning with Chemist and ending with Premed, Pharmacy, and Dentistry Major), all have codes that are permutations of I, A, R, and S. With the exception of Architect, all begin with I. (The code I-- was used as a gross summary for the Premed, Pharmacy, and Dentistry Major.) The nature of the occupations which clustered and the Holland summary code of IA R/S for the group reflect a good deal of congruency. The subcluster further subdivides into two other groups, one seeming to be more quantitatively oriented and the other more life-science oriented.

The second subcluster, SEI, is comprised of social and business occupations. Further, the four socially oriented occupations remained together while the three business occupations clustered with themselves. The former subcluster has a Holland summary code of S A/I, and the code of the latter is ECS. These three-letter codes are quite meaningful when compared to the occupations within the groups. The Accountants, usually coded CES, were actually all certified public accountants (as described in the Kuder Manual [1971, p. 58]), hence the CIS code for them.

Kuder DD OIS Clusters for Women

The cluster analysis for the OIS Core Scales for Women is shown in Figure 6. The complete group summary codes and the cluster tree are in

Appendix D. The two groups resulting from the first major division are an IAS cluster of fifteen occupations and an SAI cluster of six occupations.

Figure 6

As will be discussed below, the scales apparently divided into a heterogeneous group of science, social, and business occupations and a more homogeneous group of typically feminine occupations.

Main Cluster I

For Main Cluster I the pattern of clustering and subclustering for the women's scales is remarkably similar to the men's, and the Holland codes again seem consistent with the pattern. Since the main clusters in the two analyses were so close, some further differences will be pointed out. Architect (AIR) clustered with the Art and Art Education Major scale (ASI) and separated from the science occupations at a high level. The scientific occupations subdivided meaningfully and were homogeneous in terms of Holland codes with the one exception of Lawyer. Lawyer, clustering as it did, is difficult to understand. Electrical Engineer, the only engineering scale on the woman's profile, grouped somewhat sensibly with the life-scientists. Social Caseworker (SIA) and the business occupations (Accountant [CES], Business and Marketing Major [E--] and Personnel Manager [SAI]) initially remained apart from the science occupations, as would have been expected in terms of Holland codes. The further division of Social Caseworker (SIA) from business occupations (ECS) also would have been predicted based on the occupational codes.

Main Cluster II

Two points concerning the occupations within this cluster are important: 1)none of these appear in the men's profile, and all are typically feminine occupations; 2) all of the scales were derived from female criterion groups (Kuder, 1971, p. 56). With the exception of Art and Art Education Majors, every OIS women's scale normed on female groups clustered together. The remainder of the scales were developed by comparing women's responses to male criterion groups, and these all grouped in Main Cluster I. Analogous to this was the Main Cluster I for the men's scales, which contained primarily masculine occupations.

On this basis, then, Main Cluster II seems to represent a homogeneous group of women's occupational scales. The Holland summary code of SAI for the cluster clearly reflects this phenomenon. The remaining subclustering seems somewhat unclear. Two inconsistencies are reflected where Secretary (CSA) clusters with two SAI occupations, and Home Economics Education Major (SAE) splits off by itself at a high level. In any case, the cluster of these six scales seems to be highly homogeneous relative to the other main clusters.

Discussion

The results of this study provide evidence of the validity of Holland's occupational classification in three ways. First, occupations in the empirical clusters from the SVIB, MVII, and the OIS for both men and women possess similar Holland codes. Second, the clusters suggest that a few broad groups of occupations exist that are internally consistent. Third, the hierarchical structure of the clusters follows the hexagonal ordering of the occupational categories that has been suggested in other studies.

Interpretation of the results of the analyses must be done cautiously. Individually and collectively, the instruments that were analyzed include relatively few occupations, so all interrelationships that would occur in the world of work are not necessarily accounted for in these analyses. In addition, the clusters are largely instrument-specific regarding the questionnaire items and scoring methods. Despite these precautions, a great deal of similarity is apparent among the results for the four instruments.

The SVIB contains scales for a larger number of occupations than the other instruments analyzed in the study. Other than the R category, each of Holland's types is adequately represented by the SVIB. At higher levels of the cluster hierarchy for the SVIB, classifications into groups occur with respect to the first letter of the occupational code. In large clusters where two or more of Holland's types appear, the types are usually hexagonally contiguous and thus related. Divisions at lower levels on the cluster hierarchy sometimes were predictable from the second or third letters of the Holland code. Many clusters consisted of occupations with Holland codes of the same three letters but in various permutations. This result suggests that all three letters in the Holland occupational code are important in describing occupational characteristics. That all occupations in the clusters were not perfectly homogeneous may have been the result of misclassifications in Holland's scheme, deficiencies in the measurement instrument, or the inability of the cluster analytic method to adequately resolve differences in the data. It is reasonable to assume that all three problems contributed to what appear to be misclassifications.

The cluster analysis of the MVII provides support for the notion that within any one category of Holland's classification, occupations may be further subcategorized in a meaningful way by using second and third letters of the codes. The MVII scales are primarily Realistic occupations and would, in general, be representative of that category of occupations.

When the MVII scales cluster, those that involve contact with people stay together, and those that involve the manipulation and modification of materials stay together. The former group of occupations require more social competencies and interests, while the latter require more investigative competencies and interests. The second letters of Holland codes reflected this difference in terms of the social and investigative components in the group summary codes. The results of the MVII analysis offer the clearest support of the meaningfulness of the second and third letters of the Holland code.

Results for clusters of the OIS core scales were parallel for men and women: each had one main cluster that appeared to be sex specific; the other main cluster was similar for both sexes. The sex-related cluster for men included primarily Realistic occupations. For women the sex-related cluster was mostly composed of Social occupations. In both cases these clusters are consistent with popular masculine-feminine stereotypes, and reflect the male-female roles that are found in our culture.

The main cluster that was similar for both sexes consisted of occupations that were science, social service, and business oriented. Further clustering and subclustering were much the same for the men and women,

and were consistent with results that would have been expected in terms of Holland's codes.

Our results appear consistent with several related studies. Cole and Hanson (1971) performed a spatial configuration analysis of fifty SVIB occupational scales for a group of men (N = 301). The technique involved the fitting of a least squares plane to points resulting from a principal components analysis of the occupational scales intercorrelational matrix obtained from the Manual for the Strong Vocational Interest Blank for Men and Women (1966). The analysis provided a geometric representation of the internal structure of the interest inventory.

Each occupation was "mapped" in terms of its relationship to other scales. Cole and Hanson also assigned Holland codes to each occupation, placed each in one of the six categories according to its code, then averaged the positions for all the occupations within each category. The mean planar locations for each of the Holland categories are represented by the large dots in Figure 7. The arrangement is identical to the hexagonal ordering based on the inverse of the correlations between VPI scales: RIASEC.

A comparison can be made between the cluster and spatial configuration analyses of the SVIB scales. The clusters resulting from the McQuitty technique can be mapped indirectly. Those occupations within any particular cluster can be located on the Cole and Hanson map and a circle drawn around them. Using this procedure the occupations included within the first two subdivisions of Main Clusters I and II were located on Figure 7.

Forty-two occupations appeared both in the configural and cluster analyses. Of these, eleven were part of the IA Directed and seven were part of the SA Directed clusters of Main Cluster I; while eight and sixteen occupations were part of the IR Directed and SE Directed clusters, respectively, of Main Cluster II.

When the occupations which grouped together as a result of the cluster analysis are circled, the correspondence between the results of the two analyses is immediately apparent. No gross discrepancies in classification occur; the only overlap among groups occurs with Pharmacist, which falls in the other cluster of Main Cluster II. Each group of the cluster analysis falls along the corresponding axis of the configural analysis when codes are summarized and used as labels for the groups.

The MVII was also analyzed in the same manner (Cole and Hanson, 1971). However, since only the homogeneous keys were used and no scale-by-scale analysis was possible, the comparison in terms of the MVII is not attempted in this report.

Figure 8 shows the comparison between Cole and Hansen's configural analysis of the Kuder DD OIS core scales for men and the cluster analysis of the same scales. All occupational scales were included in both analyses. The two main subdivisions for Main Clusters I and II are circled in Figure 8. These are grouped similarly for each analysis with no gross discrepancies. Each cluster was located along the corresponding axis of the hexagon formed by joining the mean planar locations for each of Holland's categories. No configural analysis of the Kuder DD OIS core scales for women were available for further comparisons.

References

Borgen, F. H. & Weiss, D. J. Cluster analysis and counseling research. Journal of Counseling Psychology, 1971, 18, 583-591.

Campbell, D. P. Manual for the Strong Vocational Interest Blank for Men and Women. Stanford, California: Stanford University Press, 1966.

Campbell, D. P. Handbook for the Strong Vocational Interest Blank. Stanford, California: Stanford University Press, 1971.

Clark, K. E. & Campbell, D. P. Manual: Minnesota Vocational Interest Inventory. New York: The Psychological Corporation, 1965.

Cole, N. S. On measuring the vocational interests of women. (ACT Research Report No. 49) Iowa City, Iowa: The American College Testing Program, 1972.

Cole, N. S. & Hanson, G. R. An analysis of the structure of vocational interests. (ACT Research Report No. 40.) Iowa City, Iowa: The American College Testing Program, 1971.

Edwards, K. J. & Whitney, D. R. Structural analysis of Holland's personality types using factor and configural analysis. Journal of Counseling Psychology, 1972, 19, 136-145.

Holland, J. L. A theory of vocational choice. Journal of Counseling Psychology, 1959, 6, 35-45.

Holland, J. L. The psychology of vocational choice: A theory of personality types and model environments. Waltham, Massachusetts: Blaisdell, 1966. (a)

Holland, J. L. A psychological classification scheme for vocations and major fields. Journal of Counseling Psychology, 1966, 13, 278-288. (b)

Holland, J. L. Manual: Vocational Preference Inventory. (Revised) Palo Alto, California: Consulting Psychologists Press, 1970.

Holland, J. L., Viernstein, M. C., Kuo, H., Karweit, N. L., & Blum, Z. D. A psychological classification of occupations. (Center for Social Organization of Schools, Report No. 90.) Baltimore, Maryland: Johns Hopkins University, November, 1970.

Holland, J. L., Whitney, D. R., Cole, N. S., & Richards, J. M., Jr. An empirical occupational classification derived from a theory of personality and intended for practice and research. (ACT Research Report No. 29.) Iowa City, Iowa: The American College Testing Program, 1969.

Kuder, G. F. General Manual: Kuder DD Occupational Interest Inventory. (Revised) Chicago, Illinois: Science Research Associates, 1971.

McQuitty, L. L. A comparative study of some selected methods of pattern analysis. Educational and Psychological Measurement, 1971, 31, 607-626.

McQuitty, L. L. & Clark, J. A. Clusters from iterative, intercolumnar correlational analysis. Educational and Psychological Measurement, 1968, 28, 211-238.

Viernstein, M. C. The extension of Holland's occupational classification to all occupations in the Dictionary of Occupational Titles. Journal of Vocational Behavior, 1972, 2, 107-121.

Figure 1

A Hexagonal Model for Interpretating Inter- and Intra-Class Relationships

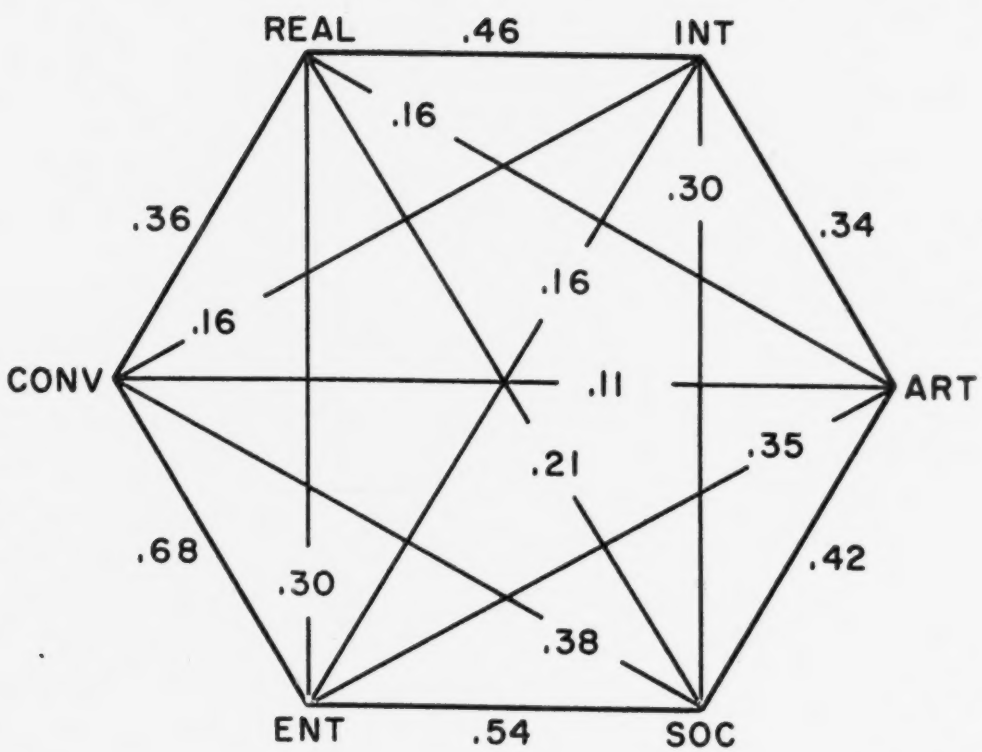


FIGURE 2

Main Cluster I for SVIB Occupational Scales Including Abbreviated Group Summary Codes, Number of Occupations at Each Level, and Descriptive Labels

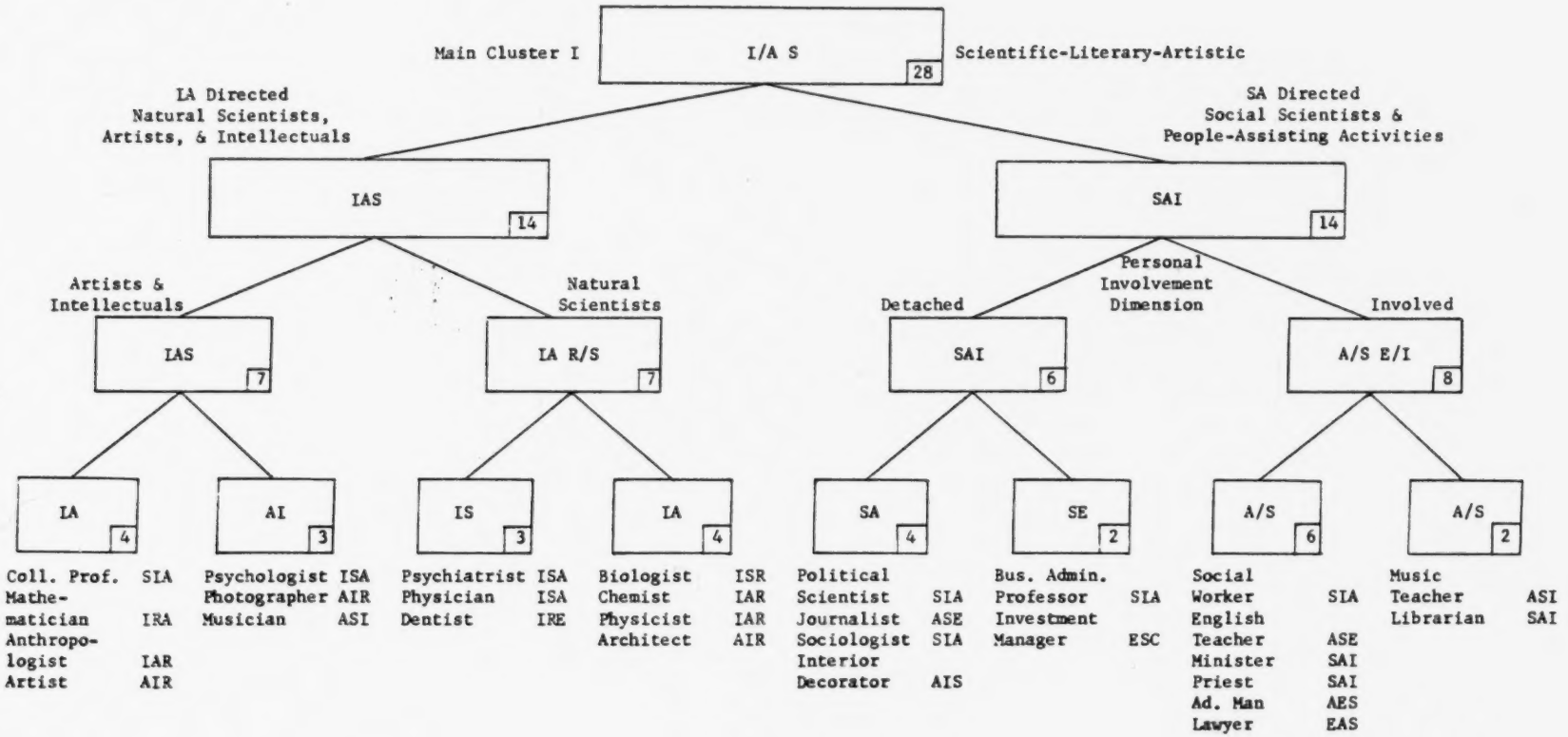


FIGURE 3

Main Cluster II for SVIB Occupational Scales Including Abbreviated Group Summary Codes, Number of Occupations at Each Level, and Descriptive Labels

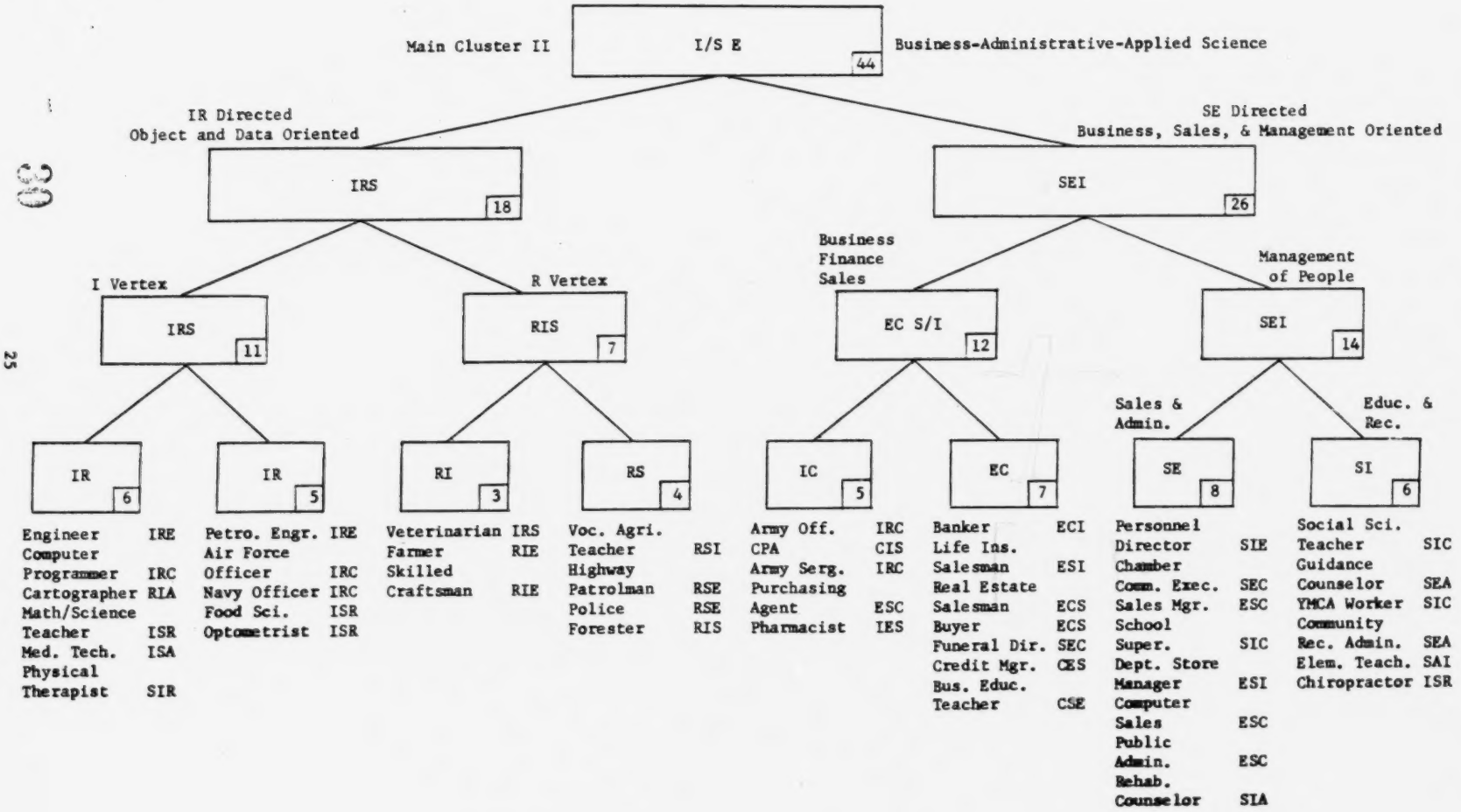


FIGURE 4

Main Clusters I and II for MVII Occupational Scales Including Abbreviated Group Summary Codes, Number of Occupations at Each Level, and Descriptive Labels

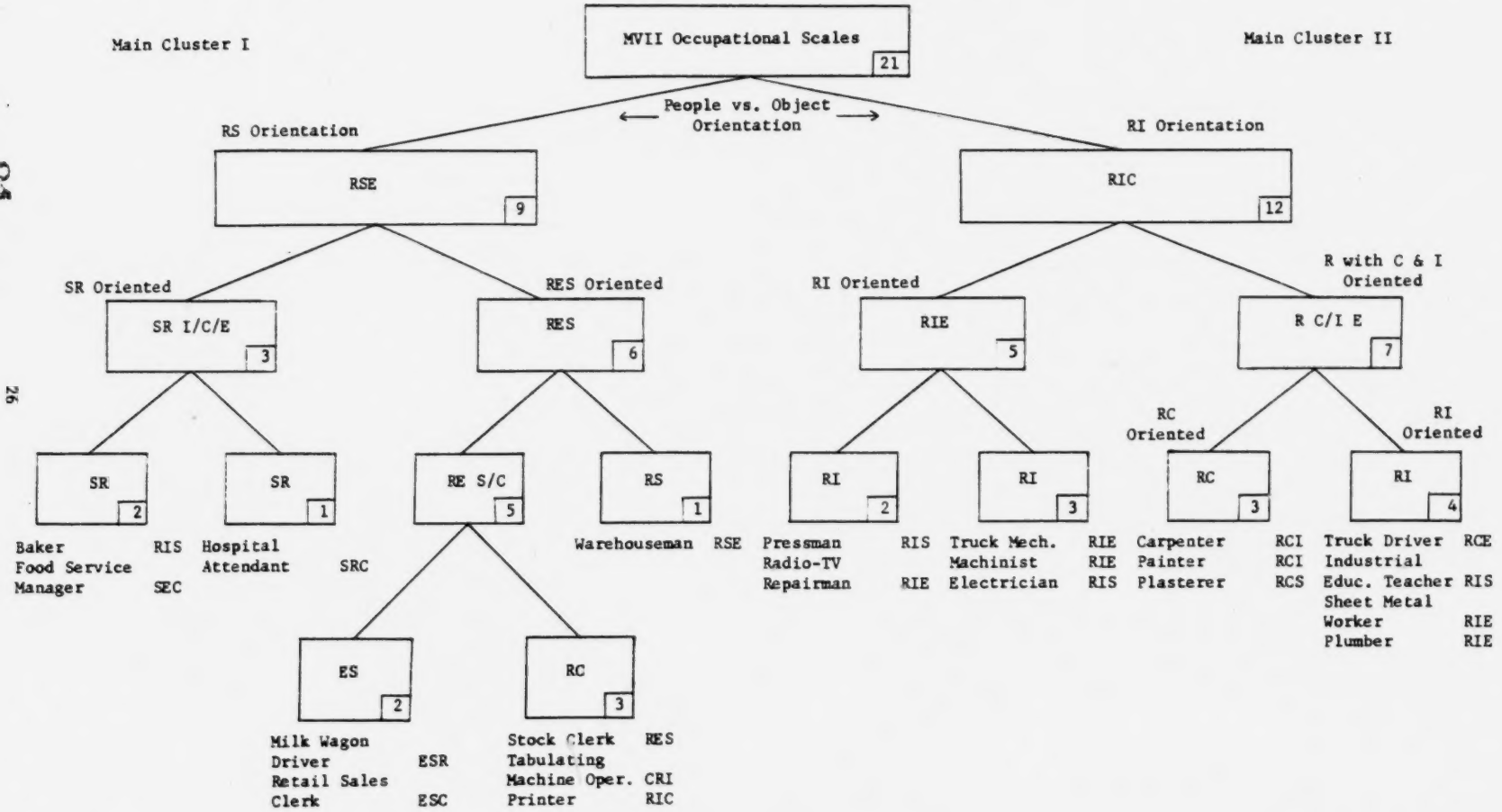


FIGURE 5

Main Clusters I and II for Kuder DD OIS Core Scales for Men Including Abbreviated Group Summary Codes, Number of Occupations at Each Level, and Descriptive Labels

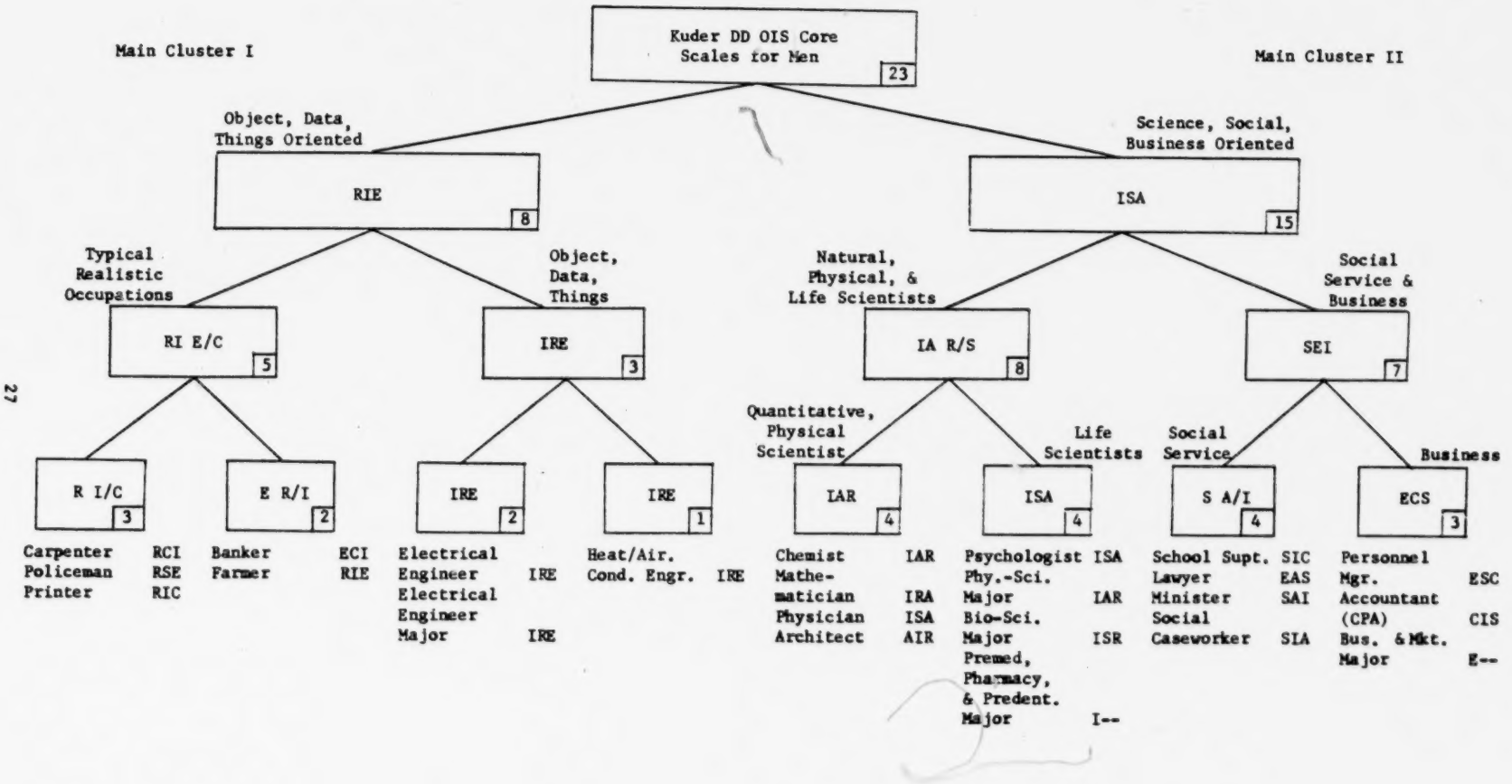
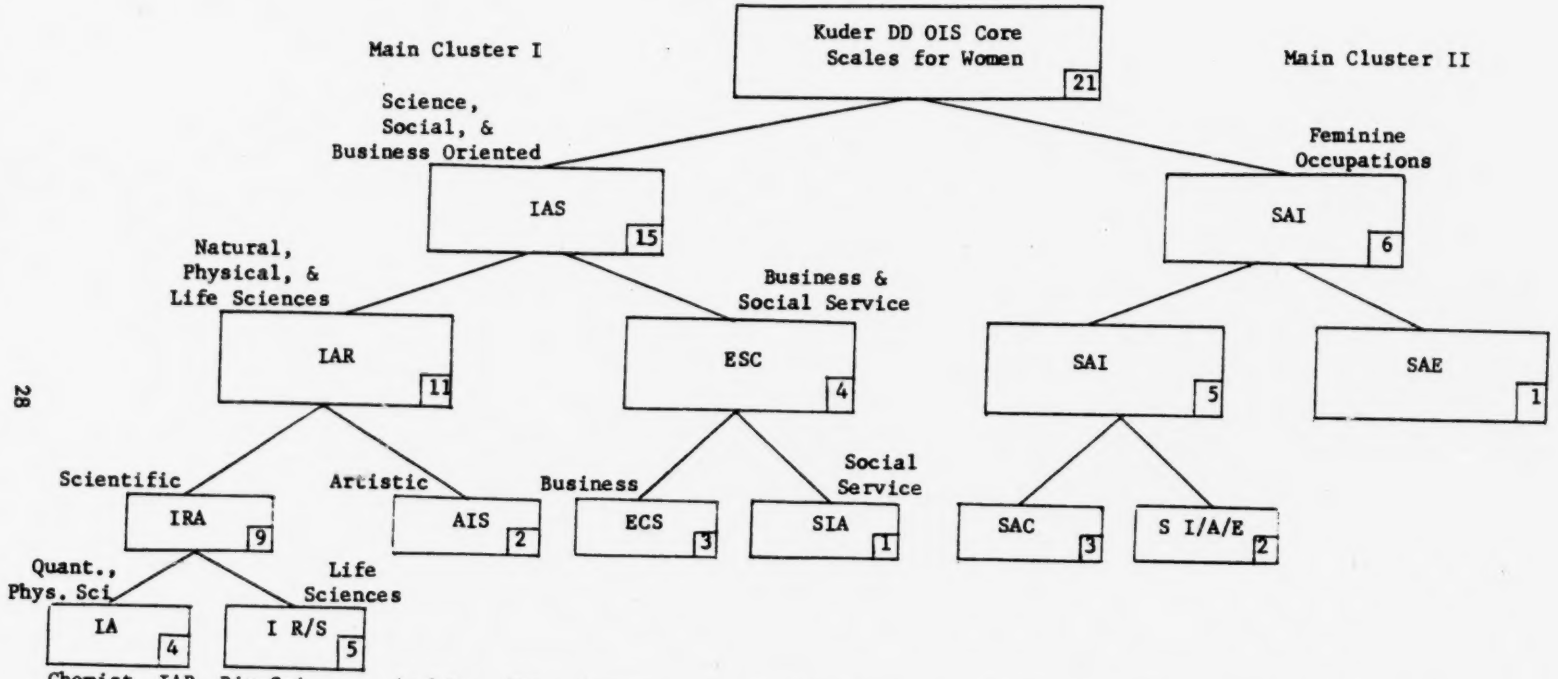


FIGURE 6

Main Clusters I & II for Kuder DD OIS Core Scales for Women Including Abbreviated Group Summary Codes, Number of Occupations at Each Level, and Descriptive Labels



*Denotes scales derived from female criterion groups.

FIGURE 7

Comparison Between Spatial Configuration and Cluster Analyses of SVIB Occupational Scales for Men

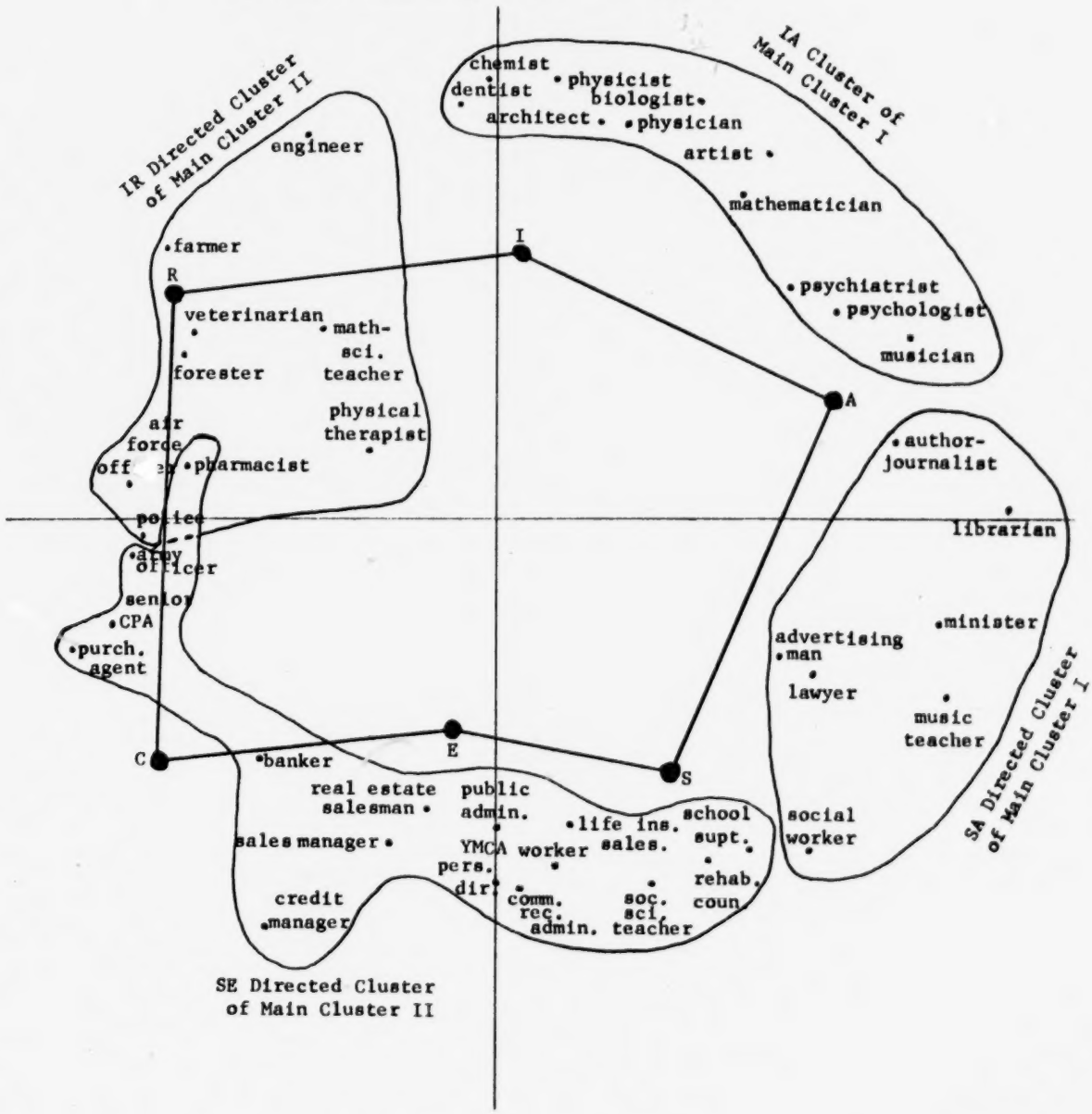
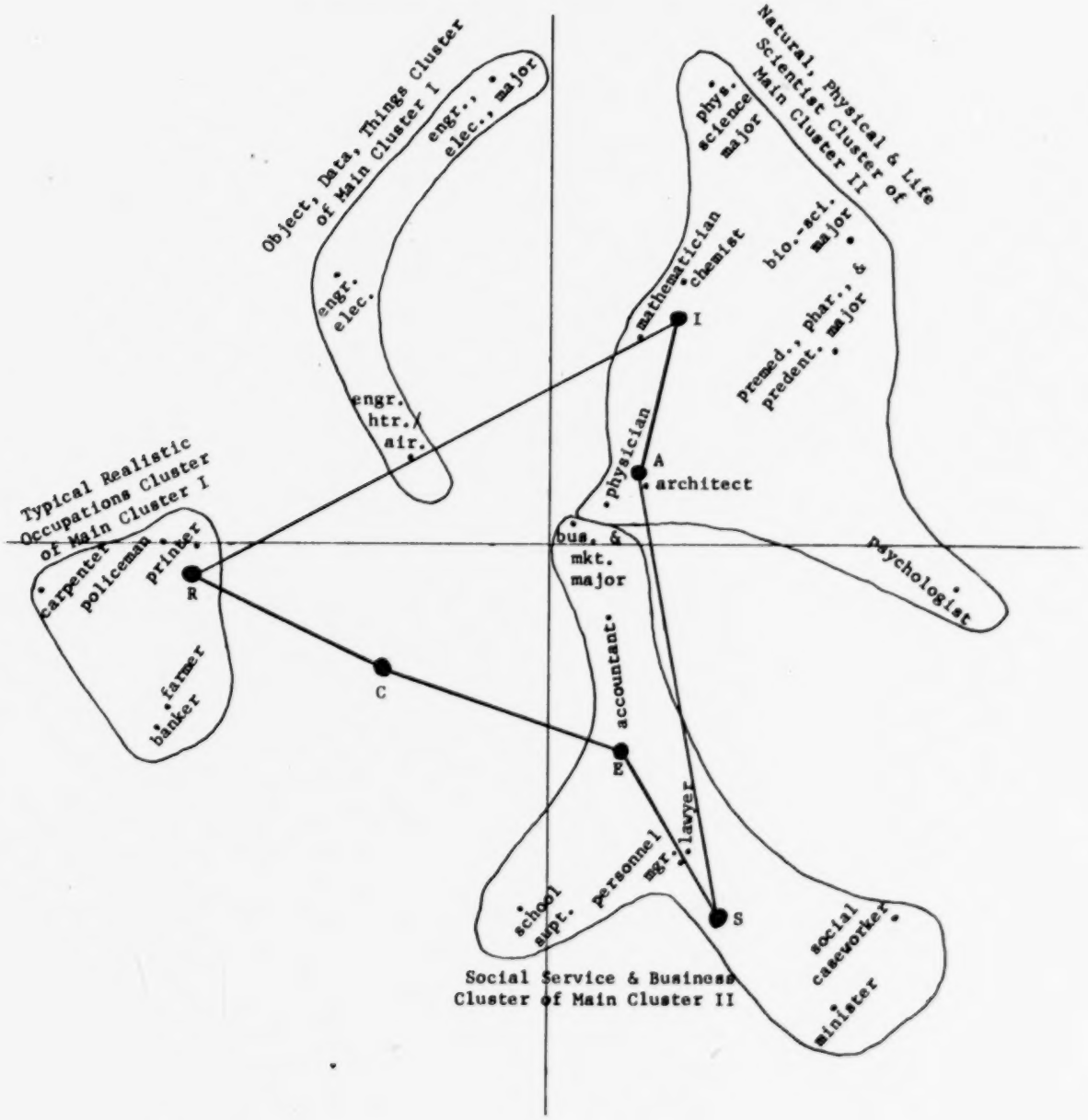


FIGURE 8

Comparison Between Results of Spatial Configuration and Cluster Analyses of Kuder DD OIS Core Scales for Men



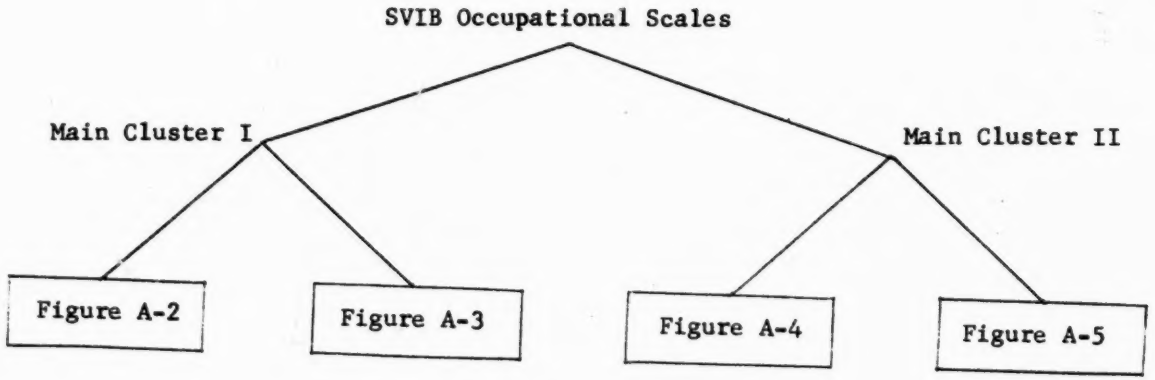
APPENDIX A

Cluster Analysis of SVIB Occupational Scales

Figure	Description
A-1	First Two Major Divisions of SVIB
A-2	Cluster Tree for One Subdivision of Main Cluster I
A-3	Cluster Tree for One Subdivision of Main Cluster I
A-4	Cluster Tree for One Subdivision of Main Cluster II
A-5	Cluster Tree for One Subdivision of Main Cluster II
A-6	Complete Group Summary Codes for Main Cluster I
A-7	Complete Group Summary Codes for Main Cluster II

FIGURE A-1

First Two Major Divisions Resulting from
Cluster Analysis of SVIB Occupational Scales



97

FIGURE A-2

Cluster Tree For One Subdivision of SVIB Main Cluster I

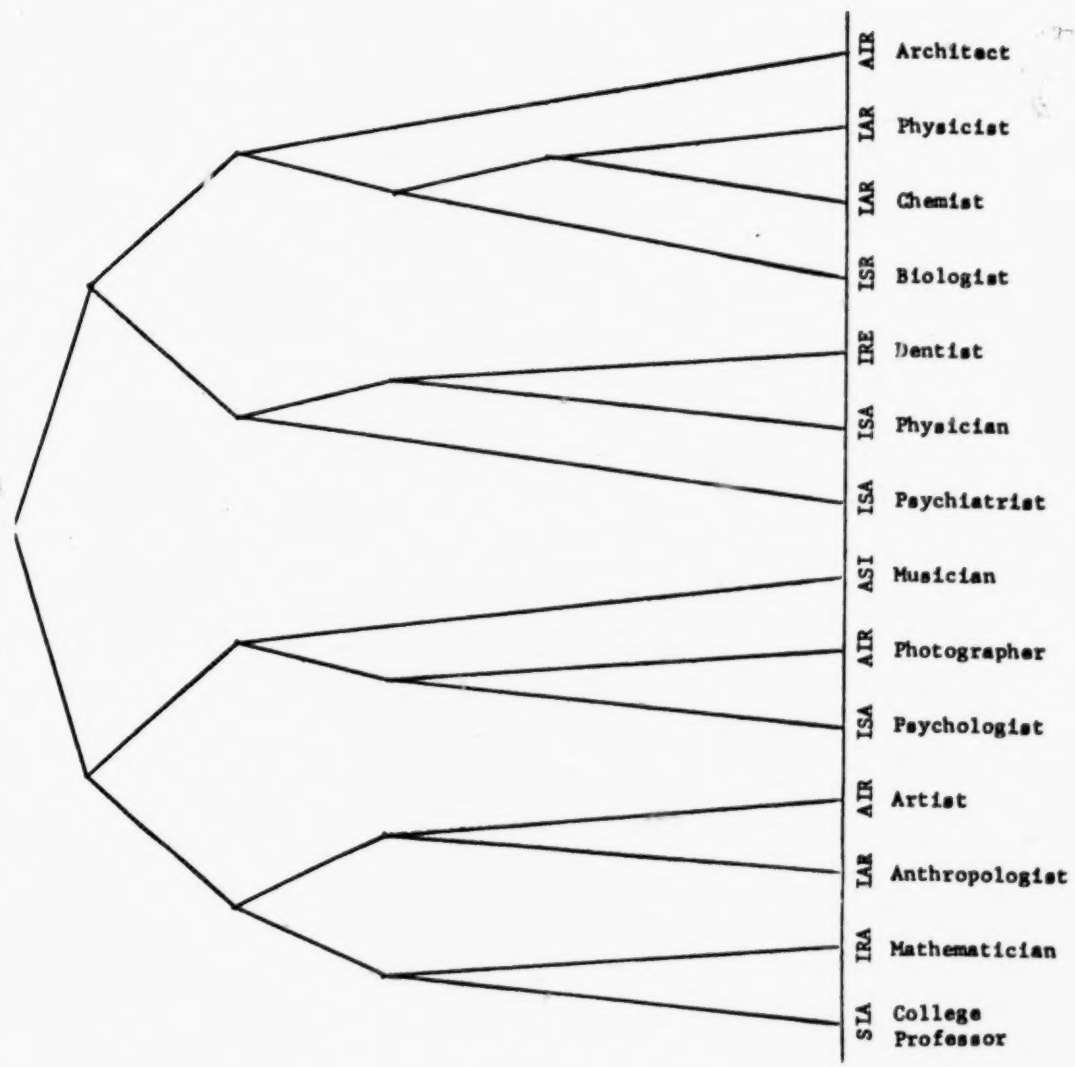


FIGURE A-3

Cluster Tree For One Subdivision of SVIB Main Cluster I

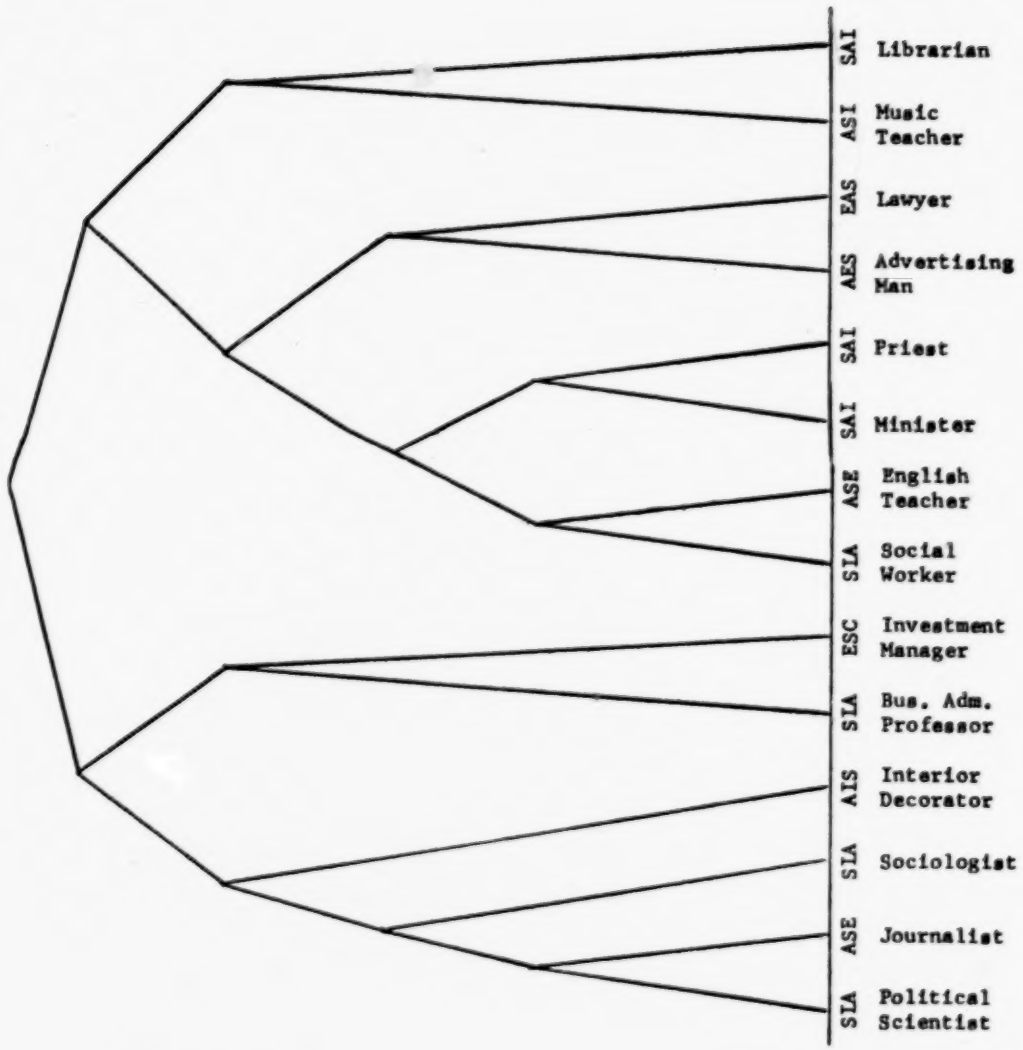
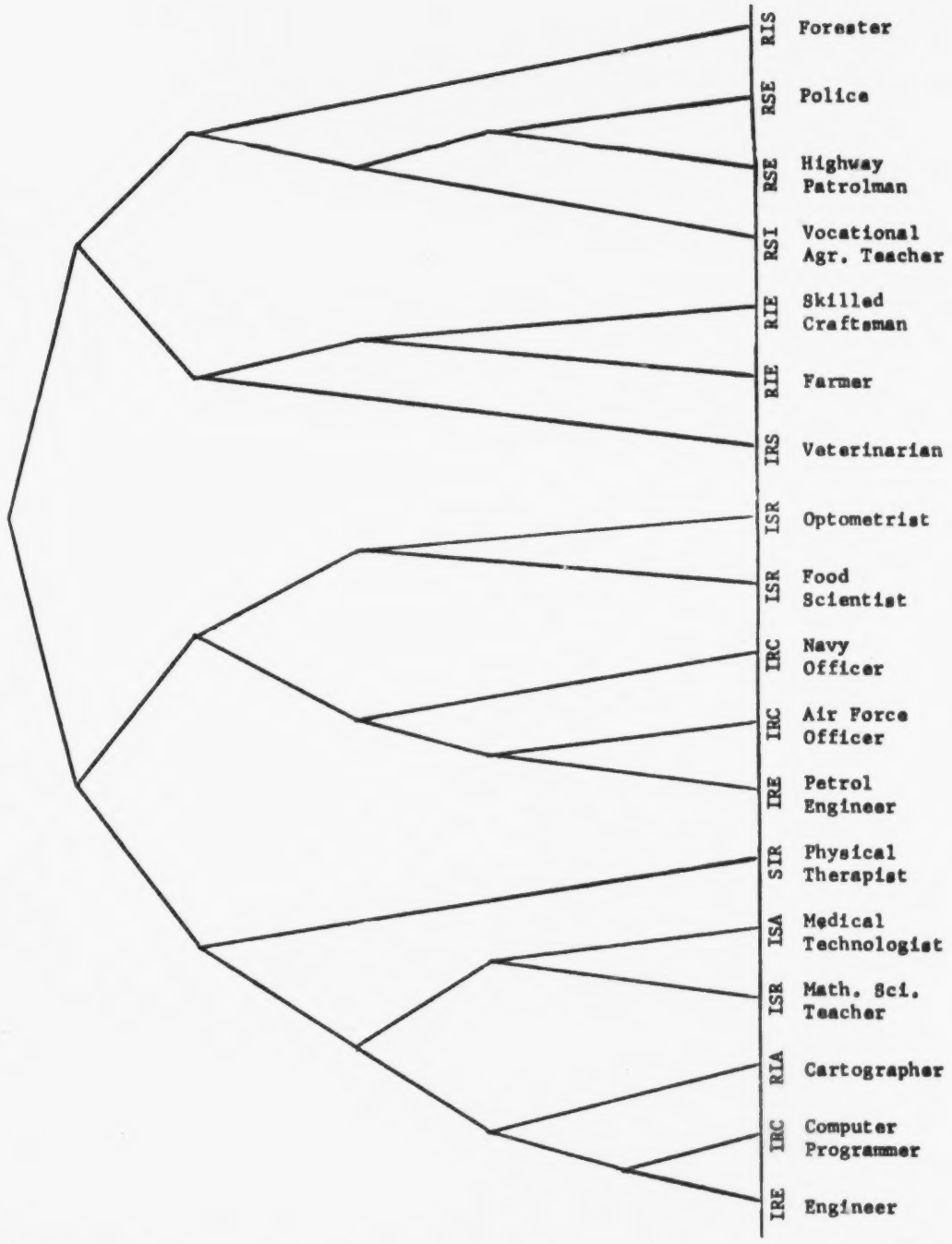


FIGURE A-4

Cluster Tree For One Subdivision of SVIB Main Cluster II



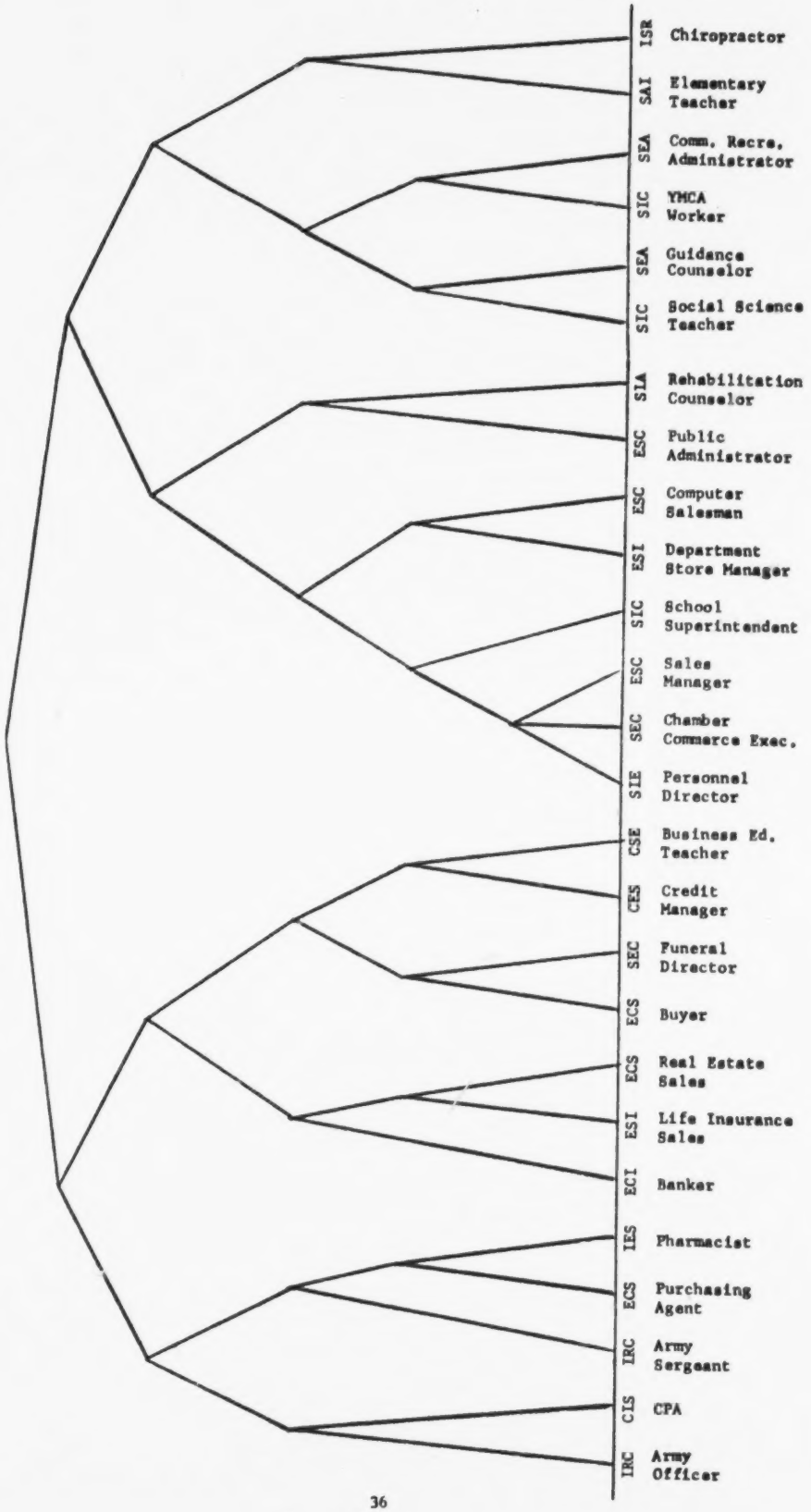


FIGURE A-5
Cluster Tree For One Subdivision of SVIB Main Cluster II

FIGURE A-6

Complete Group Summary Codes for Main Cluster I
of SVIB Occupational Scales

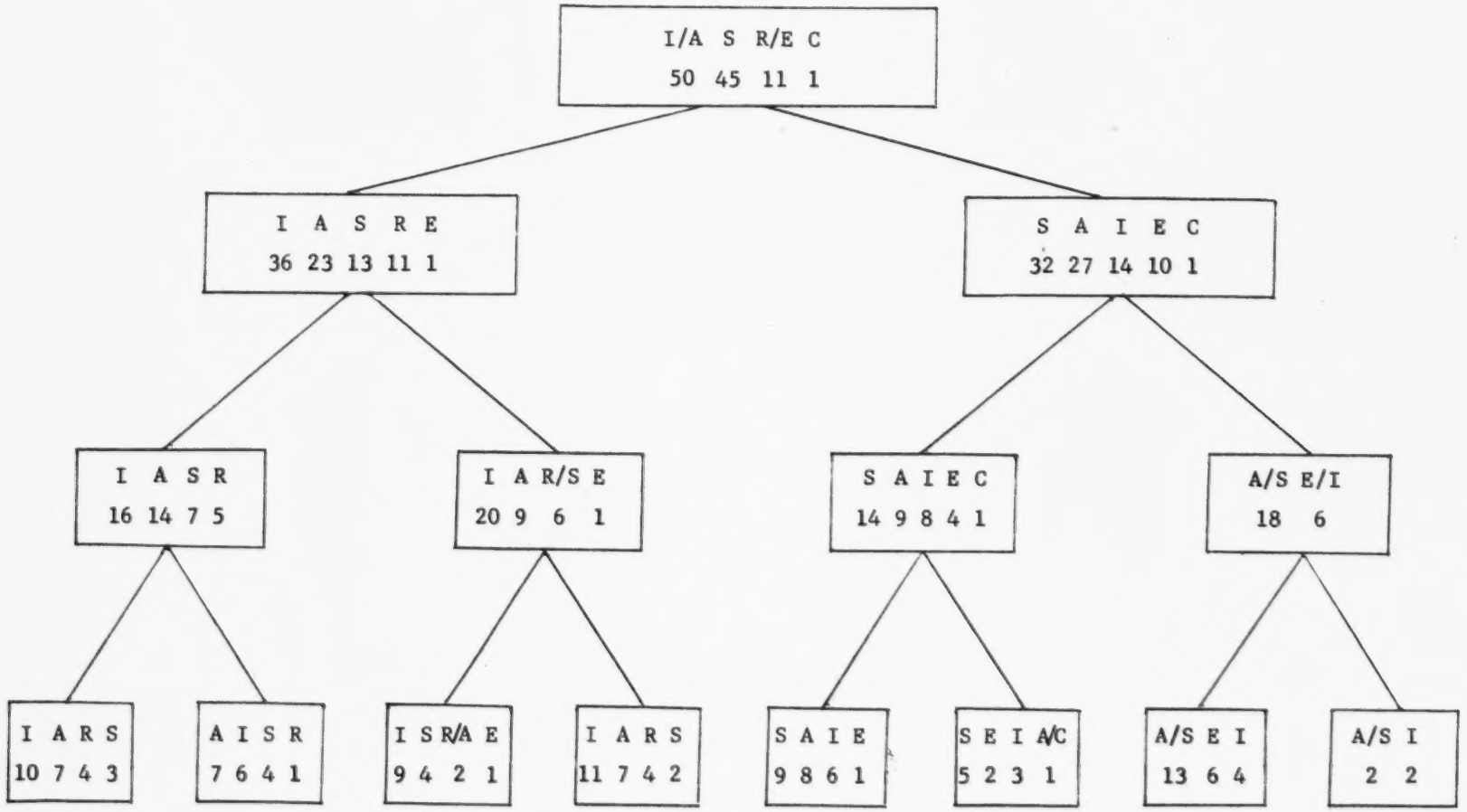
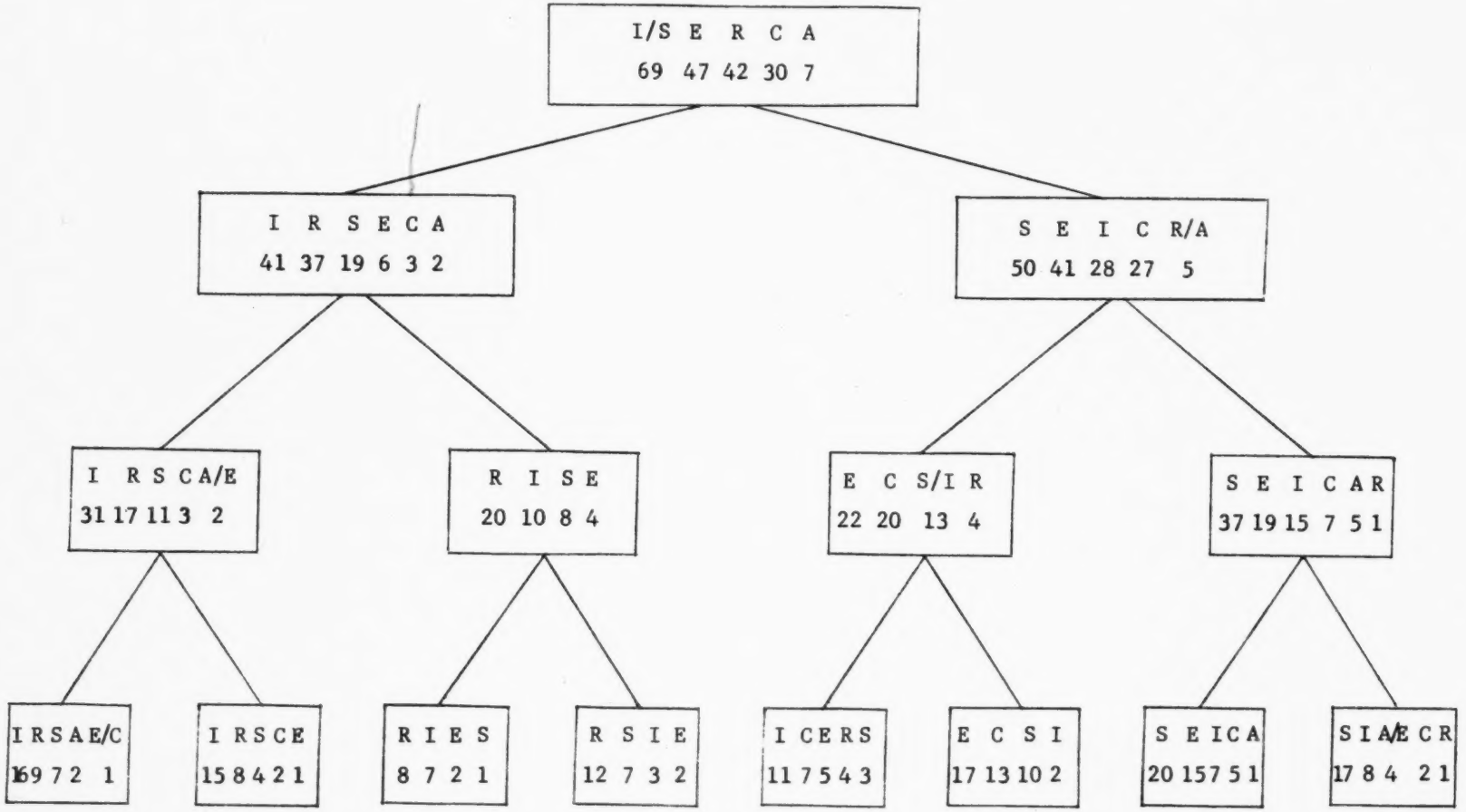


FIGURE A-7

Complete Group Summary Codes for Main
Cluster II of SVIB Occupational Scales



43

APPENDIX B

Cluster Analysis of Minnesota Vocational Interest Inventory

Figure	Description
B-1	Cluster Tree for MVII
B-2	Complete Group Summary Codes for MVII

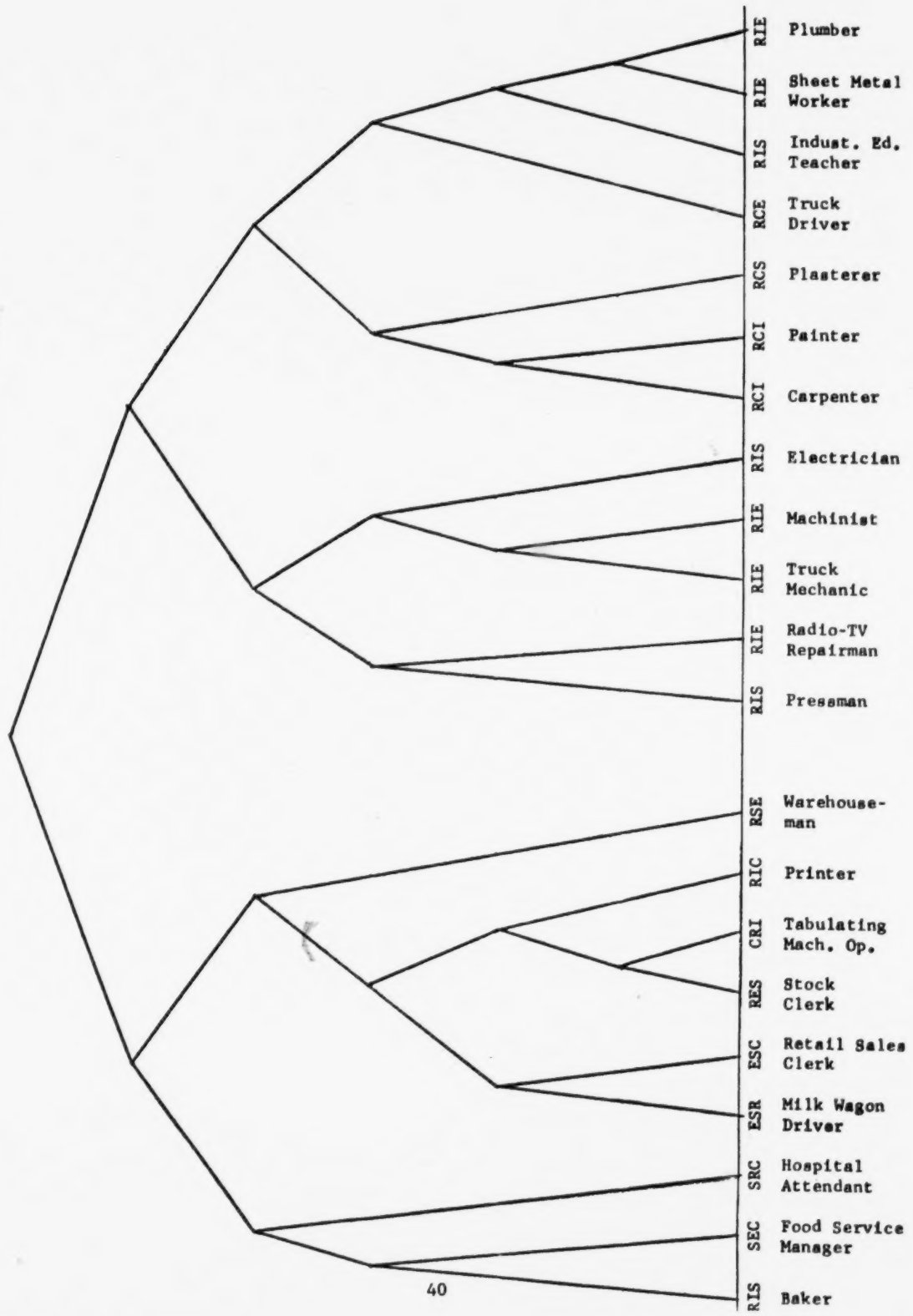
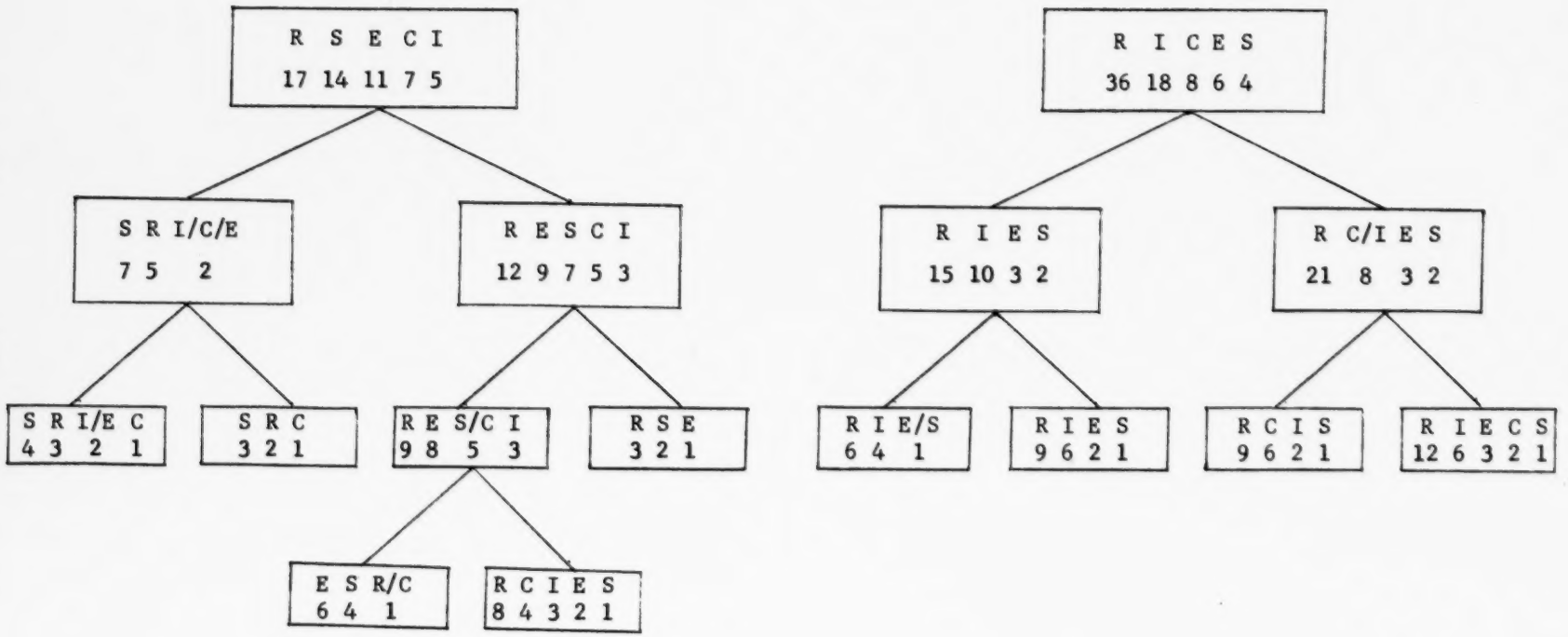


FIGURE B-1
Cluster Tree for Minnesota Vocational Interest Inventory

FIGURE B-2

Complete Group Summary Codes for Minnesota Vocational Interest Inventory



APPENDIX C

Cluster Analysis of Kuder DD OIS Core Scales for Men

Figure	Description
C-1	Cluster Tree for Men's Scales
C-2	Complete Group Summary Codes for Men's Scales

FIGURE C-1

Cluster Tree for Kuder DD OIS Core Scales for Men

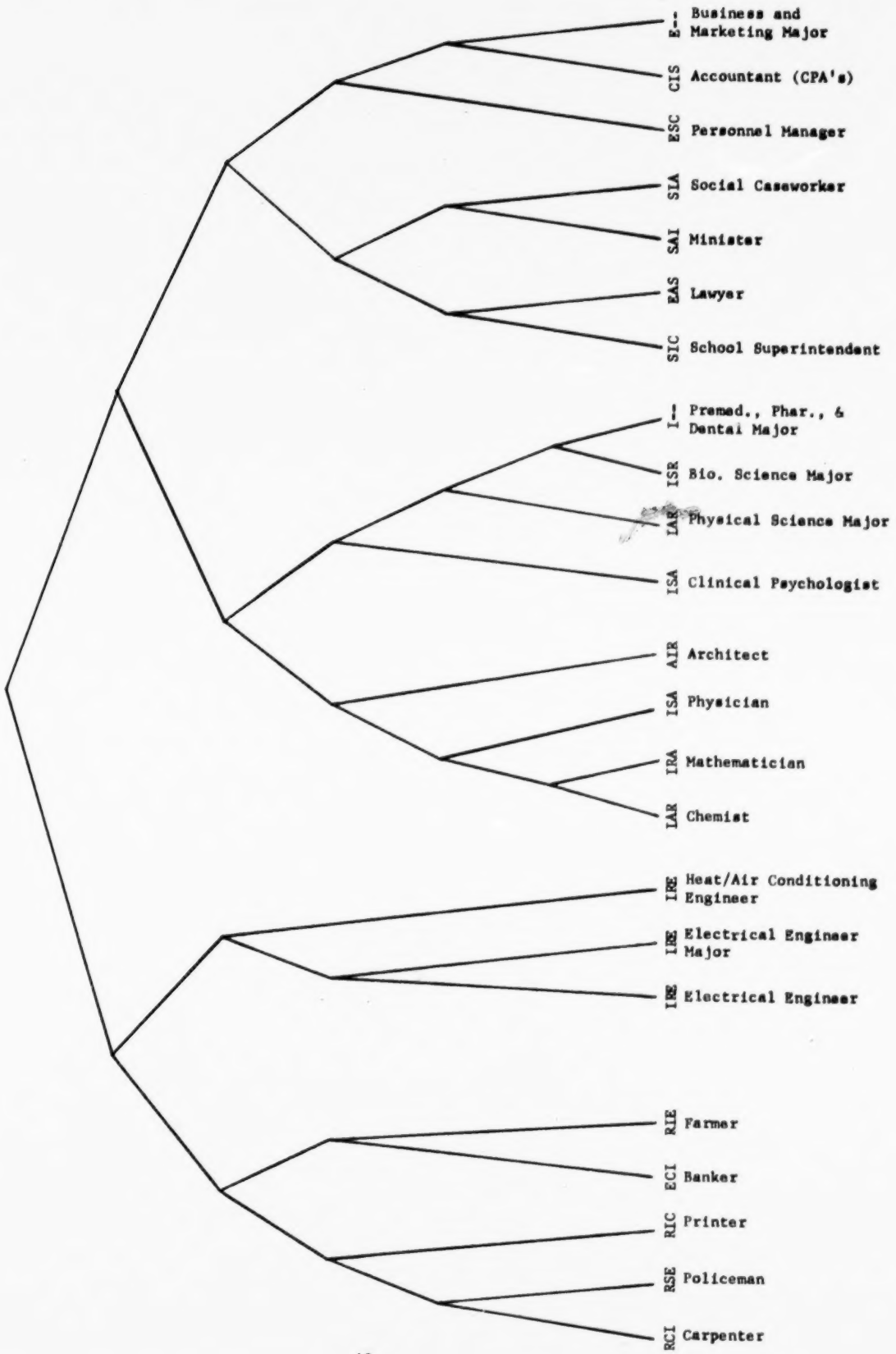
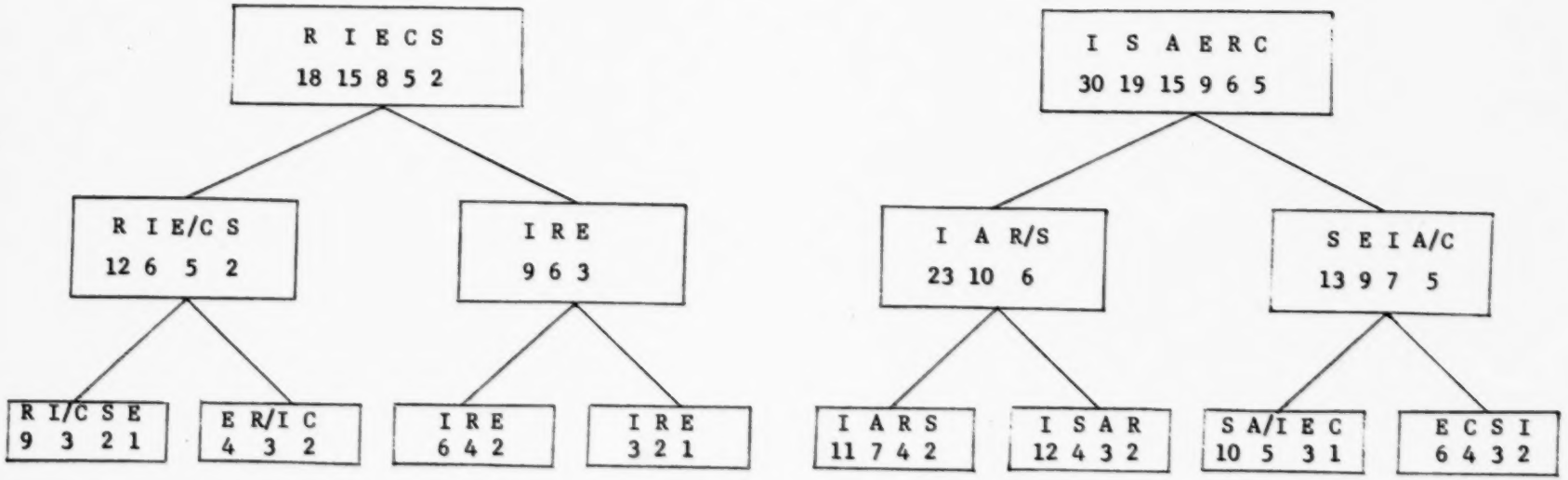


FIGURE C-2

Complete Group Summary Codes for Kuder
DD OIS Core Scales for Men



APPENDIX D

Cluster Analysis of Kuder DD OIS Core Scales for Women

Figure	Description
D-1	Cluster Tree for Women's Scales
D-2	Complete Group Summary Codes for Women Scales

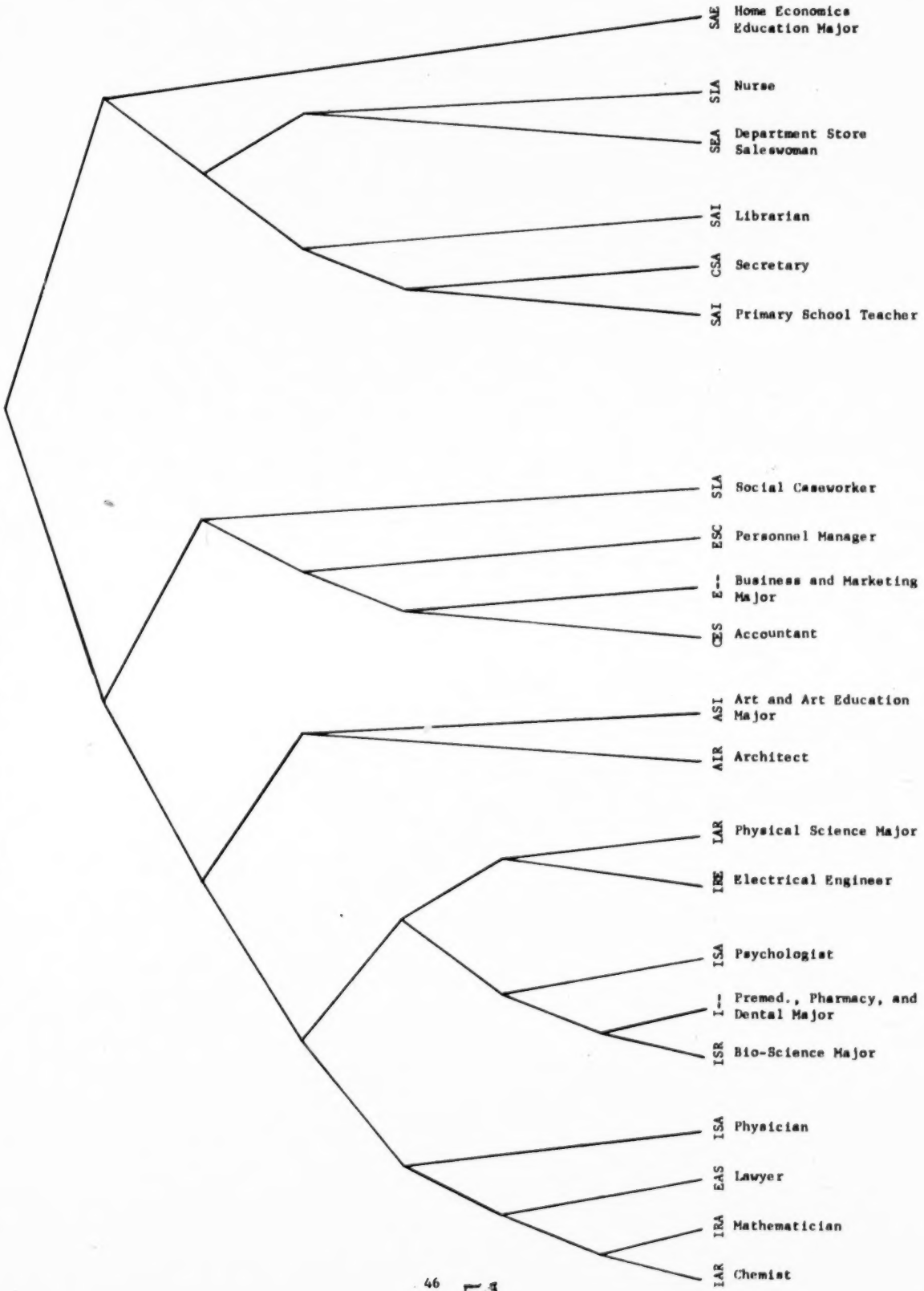
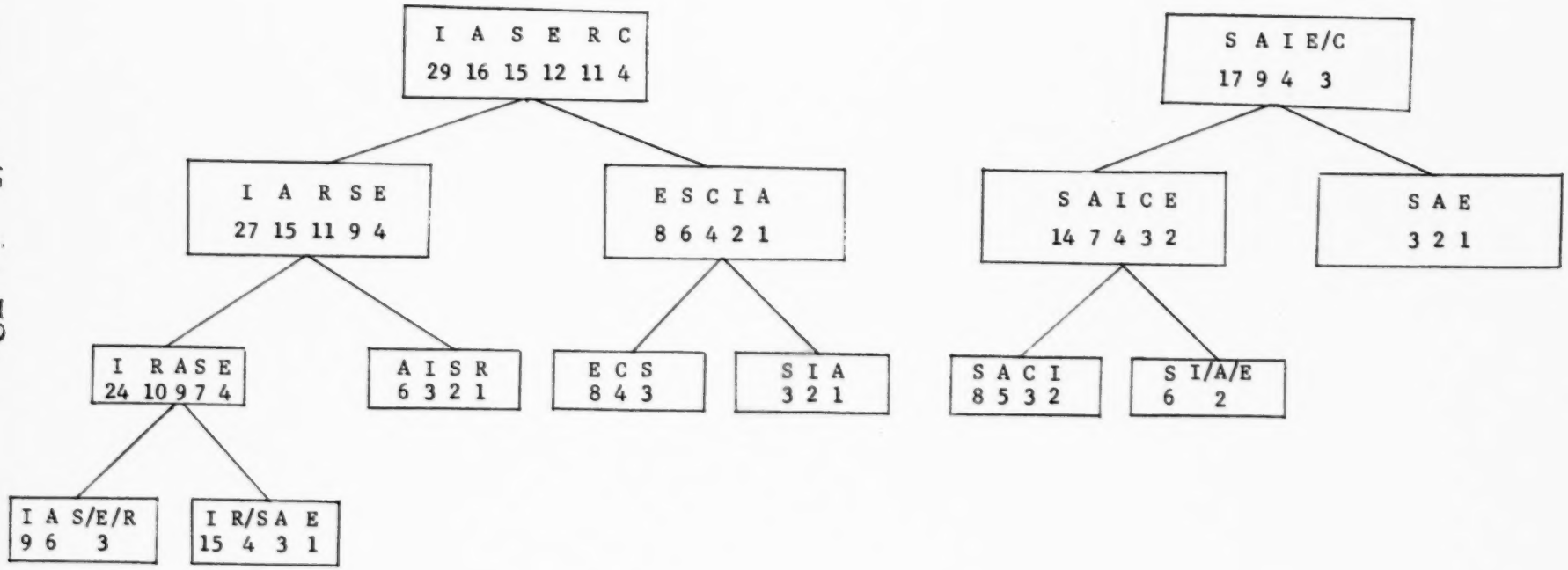


FIGURE D-1
Cluster Tree for Kuder DD OIS Core Scales for Women

FIGURE D-2

Complete Group Summary Codes for Kuder DD OIS

Core Scales for Women



62